Chapter 3
Screening and Selecting Best Management Practices

To meet stormwater management objectives for a particular development or redevelopment project, designers can select from a wide array of Best Management Practices. This selection must be based not only on the ability of each BMP to meet specific management objectives (such as peak rate control and water quality treatment), but also on site specific factors such as land use, physical feasibility, watershed resources, community and environmental factors, and operation and maintenance considerations. This Chapter addresses the screening and selection of BMPs to meet stormwater management objectives in New Hampshire, in consideration of these site specific conditions.

The design of each site should consider the following stormwater management objectives:

- Temporary Water Quality Protection During Construction
- Cold Weather Site Stabilization
- Pollutant Removal
- Recharge
- Channel Protection
- Peak Runoff Control
- Antidegradation Requirements
- Long-Term Operation & Maintenance

There are a wide range of stormwater BMPs that can be used to meet these objectives, when designed in accordance with applicable regulations and Chapter 2 Design Criteria. NHDES recommends the BMPs listed in Table 3-1 to meet stormwater management objectives. The list identifies the objective(s) each BMP meets, and references the NH Administrative Rule that applies to the design of the BMP. Table 3-2 lists the post-construction BMPs, and summarizes the applicability of the various screening factors discussed in the remainder of this Chapter. Erosion and sediment control BMPs are discussed further in Volume 3 of the NH Stormwater Manual.

Recognizing that there is no single stormwater BMP that is appropriate for every development site, this chapter outlines criteria for screening and selecting the best BMP(s) based on site specific factors, including:

Table 3-1. Best Management Practice Selection (Objectives)

BMP Type	Best Management Practice	Chapter Env-Wq 1500 Reference	Basic AOT Requirements (1503.17)								Stormwater Handbook Volume Reference
			Temporary Water Quality Protection Measures	Cold Weather Stabilization	Permanent Water Quality Protection Measures 1507.02						
							Limit changes in hydrology				
					Pollutant Removal	Recharge	Channel Protection	Peak Runoff Control	Protect Water Quality (Anti-degradation)	Operation & Maintenance	
			1505.04	1505.05	1507.03	1507.04	1507.05	1507.06	1507.07	1507.08	
Low Impact Development (LID)											Volume 1
	Site Management Practices										
		Comprehensive LID Site Design				●	●	●	●		
		Disconnect Impervious Area				●	●	●	●		
		Minimize Disturbance Area				●	●	●	●		
		Minimize Site Imperviousness				●	●	●	●		
		Flow Path Practices				●	●	●	●		
		Preserve Infiltratable Soils				●	●	●	●		
		Preserve Natural Depression Areas				●	●	●	●		
		Other: Natural Vegetation Preservation, Soil Amendment					○	○			
	Interception or Recharge Practices (constructed BMPs)										
		Green Roof					○	○	○	X	
		Rain Barrel/Cistern (with on-site re-use)					○	○	○	X	
		Rain Garden/Bioretention			●	○*	○	○	○	X	
		Pervious Pavers/Pervious Pavement			●	○*	●	●	●	X	
Source Control BMPs											Volumes 1 and 2
	Street Sweeping				○				○	X	
	Snow and Ice Management				○				○	X	
Treatment BMPs											
	Stormwater Ponds	1508.03									
		Dry Extended Detention Pond With Micropool			○		○	●	○	X	
		Wet Pond			●		○		●	X	
		Wet Extended Detention Pond			●		○	●	●	X	
		Multiple Pond System			●		○	●	●	X	
		Pocket Pond			●		○		●	X	
	Stormwater Wetlands	1508.04									
		Shallow Wetland			●		○		●	X	
		Extended Detention Wetland			●		○	○	●	X	
		Pond/Wetland System			●		○	○	●	X	
		Gravel Wetland			●		○	○	●	X	
	Infiltration Practices	1508.05									
		Infiltration Trench and Drip Edge			○	●	●	●	●	X	
		In-ground Infiltration Basin			○	●	●	●	●	X	
		Underground Infiltration Basin			○	●	●	●	●	X	
		Dry Well			○	●	○	●	●	X	
		Permeable Pavement			●	●	●	●	●	X	
	Filtering Practices	1508.06									
		Surface Sand Filter			●				●	X	
		Underground Sand Filter			●				●	X	
		Bioretention System (underdrained)			●				●	X	
		Permeable Pavement (with sand bed, underdrain, and piped outlet)			●				●	X	
	Flow-Through Treatment Swale	1508.07			●				●	X	
	Vegetated Buffer (vegetated filter strip)	1508.08									
		Residential or Small Pervious Area Buffer			○	○			○	X	
		Developed Area Buffer			○	○			○	X	
		Buffers on Downhill Side of Roadway			○	○			○	X	

Table 3-1. Best Management Practice Selection (Objectives)

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			Temporary Water Quality Protection Measures	Cold Weather Stabilization	Permanent Water Quality Protection Measures 1507.02						
							Limit changes in hydrology				
					Pollutant Removal	Recharge	Channel Protection	Peak Runoff Control	Protect Water Quality (Anti-degradation)	Operation & Maintenance	
			1505.04	1505.05	1507.03	1507.04	1507.05	1507.06	1507.07	1507.08	
Pretreatment BMPs											Volumes 1 and 2
	Sediment Forebay	1508.10			●				○	X	
	Vegetated Filter Strip	1508.11			●	○			○	X	
	Pre-treatment Swale	1508.12			●				○	X	
	Flow-through Structures	1508.13									
	Water Quality Inlet				●				○	X	
	Proprietary Devices				●				○	X	
	Deep-sump Catch Basin	1508.14			●					X	
Groundwater Recharge Practices		1508.15									
	Infiltration Practices	1508.05			●	●	○	○	●	X	
	Filtering Practices Which Include Infiltration	1508.06			●	●	○	○	●	X	
	Permeable Surfaces				●	●	○	○	●	X	
Conveyance Practices											
	Detention Basin	1508.16						●		X	
	Stone Berm Level Spreader	1508.17	○							X	
	Conveyance Swale	1508.18	○							X	
	Terraced Slopes or Benching	1508.19	○							X	
	Flow Splitters									X	
	Permanent Outlet Protection		○							X	
Erosion and Sediment Control Practices											Volume 3
	Erosion Control Methods During Construction										
	Construction Phasing		●	●							
	Dust Control		●	○							
	Grading practices		●	○							
	Soil Stockpile Practices		●	●							
	Temporary and Permanent Mulching	1506.01	●	●							
	Vegetation	1506.02	●								
	Temporary Erosion Control Blanket	1506.03	●	●							
	Diversion		●	●							
	Slope Drain		●								
	Sediment Control Methods										
	Silt Fence	1506.04	●	●							
	Turbidity Curtain		●	○							
	Erosion Control Mix Berms	1506.05	●	●							
	Straw or Hay Bale Barrier	1506.06	●	●							
	Temporary Check Dam	1506.07	●	○							
	Temporary Storm Drain Inlet Protection	1506.08	●	●							
	Temporary Construction Exit	1506.09	●	●							
	Temporary Sediment Traps	1506.10	●	○							
	Temporary Sediment Basins		●	○							
	Construction Dewatering	1506.11	●	○							
	Flocculants	1506.12	●								

● Applicable

○ May be applicable w/ careful design

X Must be addressed in O&M Plan

* Rain gardens, bioretention areas, and pervious paver/pavement systems may provide recharge, if designed without underdrains to meet infiltration practice requirements.

Table 3-2. Best Management Practice Selection (Factors)

BMP Type	Best Management Practice	Chapter Env-Wq 1500 Reference	Physical Feasibiliy Factors																		
			Drainage Area (acres)					Soil Infiltration Capacity (inches per hour)			Depth to High Water Table / Depth to Bedrock*		Land Area		Slope		Maintenance Sensitivity
			0-5	5-10	10-25	25-50	50+	<0.15	≥0.15 and ≤6.5	>6.5	0-3 ft	3+ ft	Requires Large Land Area	Requires Small Land Area			
Low Impact Development (LID)																	
	Site Management Practices																
		Comprehensive LID Site Design	●	●	●	●	●	●	●	●	●	●		●			◇
		Disconnect Impervious Area	●	●	●	●	●	●	●	●	●	●		●			◇
		Minimize Disturbance Area	●	●	●	●	●	●	●	●	●	●		●			◇
		Minimize Site Imperviousness	●	●	●	●	●	●	●	●	●	●		●			◇
		Flow Path Practices	●	●	●	●	●	●	●	●	●	●		●			◇
		Preserve Infiltratable Soils	●	●	●	●	●	●	●	●	●	●		●			◇
		Preserve Natural Depression Areas	●	●	●	●	●	●	●	●	●	●		●			◇
		Other: Natural Vegetation Preservation, Soil Amendment	●	●	●	●	●	●	●	●	●	●		●			◇
	Interception or Recharge Practices (constructed BMPs)																
		Green Roof						●	●	●	●	●		●			◆
		Rain Barrel/Cistern (with on-site re-use)	●	●	●	●	●	●	●	●	●	●		●			◇
		Rain Garden/Bioretention	●					○	●	●	●	●		●		<15%	◆
		Pervious Pavers/Pervious Pavement	●	●	●	●	●	○	●	●	○	●				<15%	◆
Source Control BMPs																	
	Street Sweeping		●	●	●	●	●	●	●	●	●	●					◆
	Snow and Ice Management		●	●	●	●	●	●	●	●	●	●					◆
Treatment BMPs																	
	Stormwater Ponds	1508.03															
		Dry Extended Detention Pond With Micropool						●	○	○	●	○	●				◇
		Wet Pond						●	○	○	●	○	●				◇
		Wet Extended Detention Pond						●	○	○	●	○	●				◇
		Multiple Pond System						●	○	○	●	○	●				◇
		Pocket Pond						●	○	○	●	○		●			◇
	Stormwater Wetlands	1508.04															
		Shallow Wetland						●	○	○	●	○					◆
		Extended Detention Wetland						●	○	○	●	○	●				◇
		Pond/Wetland System						●	○	○	●	○		●			◇
		Gravel Wetland						●	○	○	●	○					◆
	Infiltration Practices	1508.05															
		Infiltration Trench and Drip Edge	●	●					●	○		●		●		<15%	◆
		In-ground Infiltration Basin		●	●	●			●	○		●	●			<15%	◆
		Underground Infiltration Basin	●						●	○		●				<15%	◆
		Dry Well	●						●	○		●		●		<15%	◆
		Permeable Pavement	●	●	●	●	●		●	○		●				<15%	◆

Table 3-2. Best Management Practice Selection (Factors)

BMP Type	Best Management Practice	Chapter Env-Wq 1500 Reference	Physical Feasibiliy Factors: Drainage Area (acres) 0-5	5-10	10-25	25-50	50+	Soil Infiltration Capacity (inches per hour) <0.15	≥0.15 and ≤6.5	>6.5	Depth to High Water Table / Depth to Bedrock* 0-3 ft	3+ ft	Land Area: Requires Large Land Area	Requires Small Land Area	Slope	Maintenance Sensitivity
Treatment BMPs, Continued																
	Filtering Practices	1508.06														
	Surface Sand Filter		●	●				●	●	●	●	●			<15%	◆
	Underground Sand Filter		●	●				●	●	●	●	●			<15%	◆
	Bioretention System (underdrained)		●					●	●	●	●	●		●	<15%	◆
	Permeable Pavement (with sand bed, underdrain, and piped outlet)		●	●	●	●	●	●	●	●	●	●			<15%	◆
	Flow-Through Treatment Swale	1508.07									○	●				◇
	Vegetated Buffer (vegetated filter strip)	1508.08														
	Residential or Small Pervious Area Buffer		●					●	●	●	●	●	●		<15%	◈
	Developed Area Buffer		●					●	●	●	●	●	●		<15%	◈
	Buffers on Downhill Side of Roadway		●					●	●	●	●	●	●		<20%	◈
	Ditch Turn-out Buffer		●					●	●	●	●	●	●		<15%	◈
	Other practices	1508.09														
Pretreatment BMPs																
	Sediment Forebay	1508.10	●	●	●	●	●	●	●	●	●	●		●		◇
	Vegetated Filter Strip	1508.11	●					●	●	●	●	●	●			◈
	Pre-treatment Swale	1508.12						●	●	●	●	●		●		◇
	Flow-through Structures	1508.13														
	Water Quality Inlet		●					●	●	●	●	●		●		◆
	Proprietary Devices		●					●	●	●	●	●		●		◆
	Deep-sump Catch Basin	1508.14	●					●	●	●	●	●		●		◆
Groundwater Recharge Practices		1508.15														
	Infiltration Practices	1508.05	●	●	●	●	●		●	●		●			<15%	◆
	Filtering Practices Which Include Infiltration	1508.06	●	●					●	●	●	●			<15%	◆
	Permeable Surfaces		●	●	●	●	●		●	●		●			<15%	◆
Conveyance Practices																
	Detention Basin	1508.16		●	●	●	●	●	●	●	●	●	●			◇
	Stone Berm Level Spreader	1508.17	●					●	●	●	●	●			<15%	◆
	Conveyance Swale	1508.18						●	●	●	●	●				◇
	Terraced Slopes or Benching	1508.19														◇
	Flow Splitters		●	●	●	●	●	●	●	●	●	●				◇
	Permanent Outlet Protection		●	●	●	●	●	●	●	●	●	●				◈

● Applicable

○ May be applicable w/ careful design

* See Table 3-4 for a summary of BMP restrictions associated with high load and protected resources.

Maintenenance Sensitivity - a practice's susceptibility to reduced performance if not adequately maintained.

◆ Significant

◈ Moderate

◇ Least

- Land Use
- Physical Feasibility
- Watershed Resources
- BMP Capabilities
- Maintenance
- Community and Environmental Factors

The following sections discuss how these factors affect the selection of BMPs. Please note that the following discussion is intended as general guidance. The design and review of stormwater management systems must consider a wide range of factors that affect design, and final selection of BMPs will require professional judgment based on site-by-site analysis of stormwater management objectives and applicable constraints.

3-1. Land Use Criteria

Nearly any BMP can be adapted for a particular land use, as long as the physical feasibility factors discussed under Section 3-2 can be met. However, there are some land uses, specifically high-load areas and water supply areas where the use of some BMPs are restricted to avoid potential contamination of water resources. These uses are described below, followed by a summary table of restrictions for BMP implementation in these areas (Table 3-3).

High-Load Areas

High-load areas are defined as:

1. Any land use or activity in which regulated substances are exposed to rainfall or runoff, with the exception of road salt applied for deicing of pavement on the site;

2. Any land use or activity that typically generates higher concentrations of hydrocarbons, metals or suspended solids than are found in typical stormwater runoff, including but not limited to:

    - Industrial facilities subject to the NPDES Multi-Sector General Permit, not including areas where industrial activities do not occur, such as at office buildings and their associated parking facilities or in drainage areas at the facility where a certification of no exposure pursuant to 40 CFR §122.26(g) will always be possible;

    - Petroleum storage facilities;

    - Petroleum dispensing facilities;

- Vehicle fueling facilities;
- Vehicle service, maintenance and equipment cleaning facilities;
- Fleet storage areas;
- Public works storage areas;
- Road salt facilities;
- Commercial nurseries;
- Non-residential facilities with uncoated metal roofs with a slope flatter than 20%;
- Facilities with outdoor storage, loading, or unloading of hazardous substances, regardless of the primary use of the facility; and
- Facilities subject to chemical inventory under Section 312 of the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Water Supply Areas

Water supply areas include water supply wells, groundwater protection areas and water supply intake protection areas, which are defined below. The locations of water supply wells and groundwater protection areas are available from the NHDES OneStop GIS website.

Water Supply Well – as defined under RSA 482-B:2, a water supply well used as a source of water for human consumption and is not a public water supply.

Groundwater Protection Areas – wellhead protection areas (WHPAs) for community and non-transient, non-community public water supply wells; and areas of groundwater reclassified as GA1 or classified as GA2 pursuant to RSA 485-C and Env-Wq 401 or successor rules, Env-Dw 901.

Water Supply Intake Protection Areas – areas within 250 feet from the normal high water mark of a surface water source or its tributaries within ¼ mile radius of an intake point, excluding areas outside the watershed of the surface water.

Tables 3-3 and 3-4 summarize setback distances and other restrictions on BMPs installed in the vicinity of water supply resources.

Table 3-3. Water Supply Well Set-Backs		
Well Type	**Well Production Volume (gallons per day)**	**Setback from Well (feet)**
Private Water Supply Well	Any Volume	75
Non-Community Public Water Supply Well	0 to 750	75
	751 to 1,440	100
	1,441 to 4,320	125
	4,321 to 14,400	150
Community Public Water Supply Well	0 to 14,400	150
Non-Community and Community Public Water Supply Well	14,401 to 28,800	175
	28,801 to 57,600	200
	57,601 to 86,400	250
	86,401 to 115,200	300
	115,201 to 144,000	350
	Greater than 144,000	400

3-2. Physical Feasibility Factors

Physical site constraints such as the infiltration capacity of the soil, depth to bedrock or water table, size of the drainage area, and slope can limit the selection of stormwater BMPs. Depending on the physical site constraints, certain BMPs may be too costly to install or may be ineffective. Physical feasibility factors are described below with their applicability to BMP selection summarized in Table 3-2.

Soil Infiltration Capacity

Soil infiltration capacity affects the design of stormwater management systems in several ways:

- In designing a site to minimize the generation of runoff, it is easier to maintain or mimic the natural hydrology of a site if impervious surfaces are located over areas that naturally have low infiltration capacity. This in turn helps minimize the loss of natural infiltration and/or preserves higher-capacity soils for the siting of BMPs designed to promote infiltration;

- Soils infiltration capacity must be evaluated to determine whether infiltration practices can be used to remove pollutants from stormwater runoff or recharge stormwater runoff. If soil infiltration rates do not fall within accepted ranges (see Table 3-5), then the top three feet, or more of soil must be amended to fall within these ranges or other BMPs will be required to provide water quality treatment.

Table 3-4. Summary of BMP Restrictions Associated with High-Load and Protected Resources

Protected Resources	Stormwater from High-load Areas	Stormwater From Non High-load Areas
All Areas	• No filtering or infiltration practices allowed from gasoline dispensing areas under regulated RSA 146-A or RSA 146-C • Use of unlined detention ponds or unlined swales prohibited • Source control plan required[1]	• Pretreatment is required prior to all filtering or infiltration practices • Infiltration practices must have 3' of separation from the bottom of the practice to the SHWT • Filtering practices must have an impermeable liner or 1' of separation from the bottom of the filter course to the SHWT
	• No infiltration or unlined filtering practices within areas identified by NHDES with contaminated soils or groundwater, as defined under Env-Or 600.	
Water Supply Wells	• Minimum setbacks between stormwater discharge and water supply wells (see Table 3-3)	
	• No Exemption to minimum setbacks	• Exemption to minimum setbacks – if the stormwater management system receives runoff from less than 0.5 ac.
Groundwater Protection Areas	• Infiltration practices prohibited • Unlined filtering practices prohibited	• Infiltration practices must have 4' of separation from the SHWT • Filtering practice should have: • impermeable liner, or • 1' of separation from the bottom of the practice to the SHWT, or • 1' of separation from the bottom of the filter course material and twice the depth of the filter course material recommended

Water Supply Intake Protection Areas	• Infiltration practices must have 4' of separation from SHWT
	• Filtering practice should have:
	  • Impermeable liner, or
	  • 1' of separation from the bottom of the practice to the SHWT, or
	  • 1' of separation from the bottom of the filter course material and twice the depth of the filter course material recommended
	• Minimum 100' setback between stormwater discharge and the WSIPA	

	• Shut-off mechanism required where bulk oil or hazardous material is transferred	• Exemption to 100' setback – if the stormwater management system receives runoff from less than 0.5 ac.

[1] "Source control plans" are designed to minimize the volume of stormwater coming into contact with regulated substances. Chapter 5 provides further discussion of the preparation of the Source Control Plan to specify necessary structural controls and/or operational practices to minimize contact between stormwater and regulated substances.

- Soils infiltration capacity is ultimately used in the sizing of infiltration practices when they are applicable, with soils with low infiltration capacity requiring more surface area than those with high infiltration capacity to treat the same volume of water.

The applicability of infiltration practices and groundwater recharge are summarized in Table 3-5. See Chapter 2 for a discussion on selecting a design infiltration rate.

Water Table

Table 3-5. Infiltration practices, Unlined Filtering Practices, and Groundwater Recharge Practices should not direct stormwater into the following areas:
Into groundwater protection areas where the stormwater comes from a high-load area;
Into areas that have contaminants in groundwater above the ambient groundwater quality standards established in Env-Or 603.03 or into soil above site-specific soil standards developed pursuant to Env-Or 600;
Into areas where the stormwater comes from areas that have contaminants in soil above site-specific soil standards developed pursuant to Env-Or 600;
Into areas where the stormwater comes from areas with underground storage tanks regulated under RSA 146-C or aboveground storage tanks regulated under RSA 146-A, where gasoline is dispensed or otherwise transferred to vehicles;
Into areas with slopes greater than 15%, unless the system has been carefully engineered to prevent seepage forces from causing instability.
Into areas where the infiltration rate is less than 0.5 inches per hour. If a filtering practice is used, an underdrain should be placed to assist draining
Untreated stormwater should not be infiltrated into soils where the rate is too rapid to provide treatment.

The depth to the seasonal high water table will influence the selection of BMP practices to manage stormwater runoff. High groundwater may be appropriate for some BMPs where a permanent pool is required, since the interception of groundwater will aid in maintaining such a pool. Other BMPs, such as infiltration structures, may not be appropriate if the separation between the bottom of the infiltration device and groundwater table is not sufficient to allow for water to drain from the device and to adequately remove pollutants from stormwater runoff. Table 3-2 summarizes the appropriateness of BMPs relative to the seasonal high water table.

Drainage Area

Large drainage areas typically result in a greater volume and velocity of stormwater runoff than small drainage areas. Some types of stormwater BMPs can be sized to handle the contributing volume of stormwater runoff from both small and large drainage areas. However, some BMPs provide more efficient treatment and are more appropriate for small drainage areas. Also, other BMPs (such as treatment ponds or wetlands) rely on larger drainage areas to help sustain permanent pools included in their design. The applicability of BMPs to certain size drainage areas is summarized in Table 3-2.

Slope

Water flows down hill. The steeper the slope, the faster the water flows. Sites with steep slopes are more susceptible to erosion and the generation of sediment loads due to the increased velocity of the stormwater. In selecting a stormwater BMP, the slope at and adjacent to the treatment practice, the slope of the contributing drainage area, and the flow path should all be considered. The applicability of BMPs to various slopes is summarized in Table 3-2.

3-3. Watershed Resource Factors

It is important to look not only at the impacts the development will have at a site, but also how downstream resources may be impacted by development activities. Table 3-6 summarizes the downstream water resources that should be considered when selecting stormwater BMPs. Each of these resources is discussed further below.

Table 3-6. Watershed Resource Criteria

Sensitive Receiving Waters	If cold water fisheries are present, select BMPs that will reduce thermal impacts.
Water Supplies: Aquifers Maximize infiltration following setbacks in Table 3-3.	Maximize infiltration following setbacks in Table 3-3.
Surface Water Supplies & Lakes and Ponds	Select BMPs with high phosphorus and sediment removal to reduce the rate of eutrophication. Select BMPs with high bacteria removal when waters are used for recreation.
Estuary and Coastal Areas	Select BMPs with high nitrogen and bacteria removal to reduce closure of swimming beaches and shellfish beds.

Sensitive Receiving Waters

Impaired waters, outstanding resources waters (ORWs), coldwater fisheries, prime wetlands , and wetlands that have highly rated functions and values are a few examples of receiving waters that may be more sensitive to development activities and could require additional measures to protect or restore their unique properties. Toxic pollutants such as metals, soluble organic compounds, and bacteria are of particular concern for waters that could serve as future water supply sources. Rivers that support cold water fisheries are very sensitive to increases in water temperature, which are often caused by stormwater running over heated impervious surfaces that lack of sufficient buffers to provide shade. Downstream flooding and channel erosion are also important considerations.

Water Supplies: Aquifers and Surface Waters

Over 60 percent of New Hampshire residents rely on groundwater for their drinking water from either private wells or public water supply wells. Because of this, it is important to maintain pre-development groundwater recharge rates and to avoid groundwater contamination in order to maintain adequate, high quality groundwater supplies for drinking water, as well as to maintain dry weather base flows in streams and rivers. The remaining residents in the

state are served by public surface water reservoirs. Surface water supplies are particularly susceptible to contamination by bacteria and other pollutants. Because of the potential for groundwater and surface water contamination of drinking water supplies, the NHDES has established BMP setback requirements (see discussion under "Land Uses") as summarized in Table 3-3 based on the type of water supply and withdrawal amount, and in Table 3-4 in relation to high-load areas.

Lakes and Ponds

Lakes, ponds, and other freshwater systems are more sensitive to phosphorus loading than salt water systems as phosphorus is typically the limiting nutrient in freshwater systems. Excess phosphorus in a freshwater system, such as a lake or a pond, can result in algal blooms and an increased rate of eutrophication. Because of this, development activities near lakes and ponds, as well as their tributaries, should include site design techniques and BMPs for sediment and nutrient removal.

Estuary and Coastal Areas

Estuaries and other coastal areas are more sensitive to nitrogen loading than freshwater systems as nitrogen is typically the limiting nutrient in salt water systems. The other major pollutant of concern in coastal waters is bacteria. New Hampshire's coastal beaches host nearly half a million visitors each year. New Hampshire coastal waters are also home to a variety of shellfish including clams and oysters. Public swimming beaches and shellfish beds are extremely sensitive to high bacteria levels and result in closures of swimming beaches and shellfish beds.

3-4. BMP Capability Factors

Various field and laboratory tests have determined average expected pollutant removal efficiencies for various management practices. These values, expressed as a percentage of the total load, are provided in Appendix B. As more studies are conducted and the amount of pollutant removal efficiency data grows, these estimates may change to more accurately reflect the level of stormwater treatment provided through these practices.

Pollutant removal efficiencies are dependent on many variables including proper selection, sizing and installation of the BMP, proper placement of the BMP on a site, and proper maintenance. Appendix B should be used in conjunction with Tables 3-1 and 3-2, to identify stormwater BMPs that will effectively meet the NHDES stormwater management objectives of groundwater recharge and total runoff volume reduction, stream channel protection, peak flow reduction, and pollutant load reduction.

3-5. Maintenance Factors

Regular Inspection and Maintenance

Regular inspections and maintenance are essential for long-term effectiveness of stormwater BMPs. BMPs are also very expensive to repair and replace. Sediment, trash, and other debris can accumulate in BMPs and needs to be removed periodically. If not properly maintained, the BMP will not operate as designed and will not provide effective treatment of stormwater runoff. This jeopardizes water quality and may violate permit conditions. All stormwater BMPs require maintenance, however, the frequency and difficulty of maintenance activities and the equipment needed to carry them out varies. Table 3-2 summarizes the relative level of maintenance required by each stormwater BMP. Inspectors and those overseeing or performing maintenance should be well trained and thoroughly familiar with the as-built plans for each BMP. They should be provided with detailed inspection and maintenance procedures, preferably developed by the designer who is familiar with the as-built plans.

Pretreatment

Pre-treatment devices, such as sediment forebays, can reduce the amount of sediment accumulation in the primary treatment device; however, pre-treatment practices also require maintenance. Inspections and maintenance for pretreatment devices may need to be more frequent, especially soon after construction, than the primary BMP.

Vegetated BMPs

Rain gardens, tree box filters, gravel wetlands and any BMPs with vegetation require special care. Water and fertilizer will be needed, especially when the vegetation is first established. Periodic watering may be necessary in times of drought. The amount of fertilizer used may need to be limited to the exact needs of the plants if the BMP is designed to remove nutrients. Drought or salt tolerant species may need to be specified when selecting vegetated BMPs.

Likelihood of Maintenance being Performed

Inspections and maintenance may not be assured. Even though requirements may be described in deeds, neighborhood association documents and performance bonds, the possibility exists the maintenance will not be performed. The chance of this happening increases when there is no oversight by a regulatory authority. An example would be a small non-MS4 community without a code enforcement officer. For these cases BMPs without any important routine maintenance and those that would not be costly to repair upon failure should be chosen. It may also make sense to have designs features that draw attention to the unit prior to failure, such as installing pretreatment devices in series.

Accessibility for Inspections

It is important to provide adequate access for all necessary inspections, monitoring and maintenance when designing or selecting BMPs. Below ground structures and sensitive BMPs (see below) require special design features including access manholes, clean outs, water level monitoring wells, etc. Infiltration chambers may also need groundwater (quality) monitoring wells to comply with Underground Injection Control (UIC) permit requirements. Difficult access situations, including those with safety concerns, must also be considered. These include BMPs in close proximity to buildings, high traffic areas, vegetated islands in stormwater wetlands/ponds and green roofs. Oil/water separation BMPs must also address confined space entry concerns.

Sensitive BMPs

BMPs or parts of them can be susceptible to damage during inspections and maintenance and due to environmental factors. Liners and steep side slopes of basins can be damaged when oversized vehicles are used to remove accumulated sediment. Sediment removal activities can damage many other BMPs as well, especially when vehicles such as backhoes are used. Loss of infiltration capacity is an important concern. Hand removal of sediment may be the best option. Environmental factors such as cold temperatures, human (vehicles and vandalism), salt runoff or salt air (corrosion), flooding and wildlife (damage to vegetation) should all be considered when designing or specifying BMPs to minimize maintenance requirements.

3-6. Community and Environmental Factors

It is important to think about how a stormwater BMP will fit into the community. Some community and environmental concerns that should be addressed in the selection and design of the BMP include:

- **Safety** – Does the BMP pose a safety risk? Knowledge of the surrounding community is needed to determine whether certain safety features need to be incorporated into the design and/or whether some types of BMPs should be avoided altogether. For example, deep water, as in wet ponds, may be unsuitable for a residential area with small children or may require fencing to prevent access.

- **Aesthetics** – Some BMPs are more attractive than others and can be designed to blend in with the existing or proposed landscape. The surrounding land use and users should be considered when selecting and designing a BMP. For example, will the BMP be visible? Who will see the BMP?

- **Habitat** – Some BMPs, such as stormwater ponds and wetlands, can provide wildlife and wetland habitat. The need for this habitat should be considered when selecting and designing the BMP.

- **Compatibility with Municipal Maintenance Programs** – Consider community needs when selecting and designing a BMP. If the community will be maintaining the BMP, make sure it is compatible with the community's available maintenance equipment and desired maintenance schedule.

- **Health Concerns** – Understand community concerns about mosquito breeding and the diseases carried by mosquitoes and consider these concerns when selecting and designing BMPs. BMPs with standing water for more than 72 hours may create breeding grounds for mosquitoes. Consider whether there is other standing water nearby and the surrounding land uses when deciding whether to use wet ponds, wetlands, or other BMPs with permanent standing water. When using BMPs that will have permanent pools, consider designs that maximize habitat for natural predators of mosquitoes.